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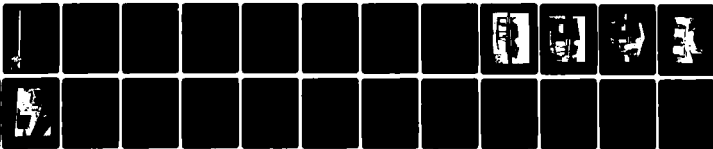
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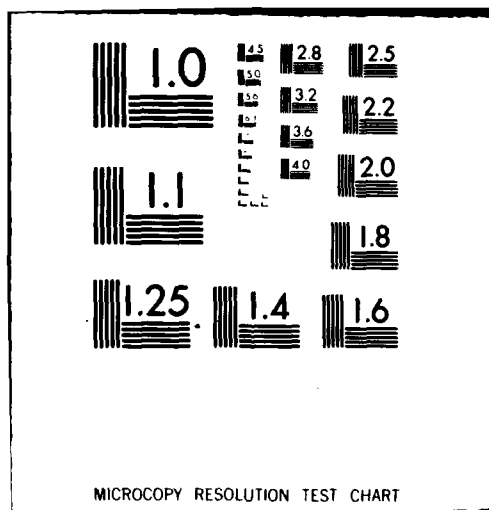
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VERIFICATION TEST OF THE BATTRONIC MINI VAN

by
Edward J. Dowgiallo, Jr.
Ivan R. Snellings
and
William H. Blake

July 1980

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U.S. ARMY MOBILITY EQUIPMENT
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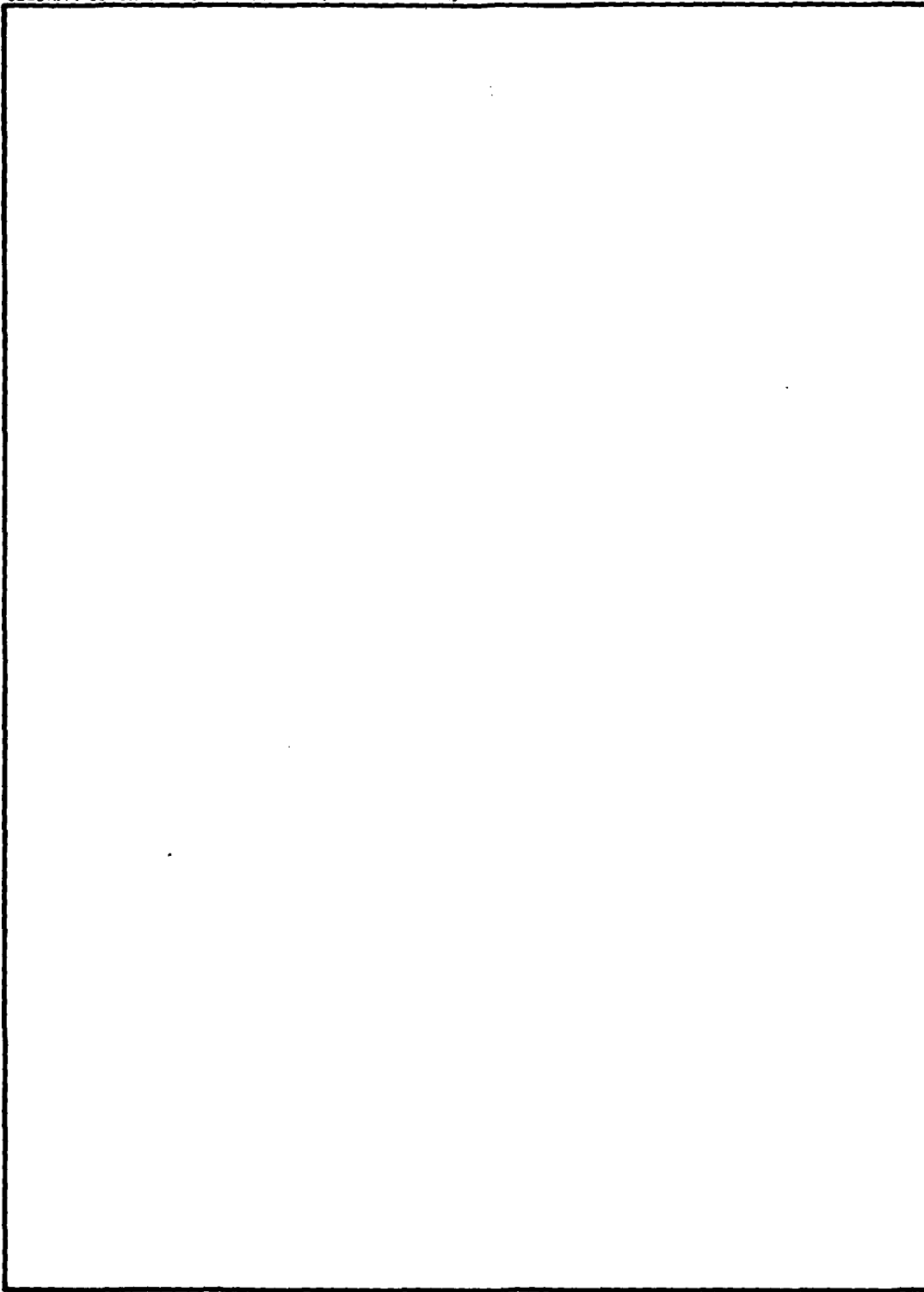
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VERIFICATION TEST OF THE BATTRONIC MINI VAN

I. SUMMARY

The Battronic Mini Van, manufactured by Battronic, Inc., Boyertown, Pennsylvania, was tested during the period from 17 January 1978 to 10 April 1978. Complete test results are contained in Section V. Part of the verification test results are summarized below:

Acceleration: 50 km/h (31.1 mi/h) in 14 s.

Range: 88 km (54.7 mi), 259 cycles of SAE J227a/type B driving cycle.

Forward Speed: 70 km/h (43.5 mi/h) for 35.3 min on the MERADCOM test track with a 5-percent grade.

Gradeability at Speed: At 25 km/h (15.5 mi/h) can traverse a 14.7-percent grade based on calculation from acceleration tests at 80-percent battery depth of discharge (DOD).

Gradeability limit: 26.5-percent grade for 20 s (calculated).

II. INTRODUCTION

The Battronic Mini Van electric vehicle was operated to determine conformity to the Department of Energy Performance Standards for Demonstrations, published in the Federal Register, 30 May 1978, Part V. The results of that testing, as performed by the U.S. Army Mobility Equipment Research and Development Command (MERADCOM), as well as other descriptive data concerning the vehicle, are presented in this report.

III. OBJECTIVES

The objectives of this test were to examine the Battronic Mini Van for suitability of those aspects of vehicle and component operating characteristics as outlined by the Department of Energy's "Performance Standards for Demonstration."

IV. DESCRIPTION OF TEST VEHICLE

The Battronic Mini Van is a commercial vehicle for use primarily as a delivery van (Figures 1 and 2). The vehicle has a wheelbase of 2.39 m (94 in.) The Mini Van has a curb weight of 2664 kg (5860 lb) and has the capacity for a 426-kg (940-lb) payload, plus driver. The batteries for the Mini Van are made by the C&D Batteries Division of the Eltra Company and are configured as two modules, one on either side of the vehicle (Figure 3). The batteries have a 292-Ah capacity. They can be accessed from outside the vehicle or from the inside (Figures 4 and 5). In the front of the vehicle are the control electronics, consisting of a Pulsomatic MKX SCR controller made by Cableform. Also, the Titan 6000MF 12-volt auxiliary battery is located in the front of the vehicle (Figures 6 and 7).

The propulsion motor is a General Electric DC motor, rated at 31.3 kW (42 hp). The Mini Van has a Clark tube-type front axle, with leaf springs in the rear, and drum brakes all around. The tires are Firestone transport 110, 6-ply, 6.70 - 15, with a C-road range, and inflated to 45 lbf/in². The Mini Van uses an off-board Hertner 208-volt charger equipped with a timer, type SFR 56-330-S.

The Mini Van comes equipped with standard equipment, such as windshield wipers, windshield washer, defroster, and odometer. The Battronic has a gasoline heater, ammeter, and battery discharge meter. The Mini Van has a Boyertown-type body, manufactured by Battronic Van. (See the Appendix for the Vehicle Summary Data Sheet.)

V. TEST RESULTS

The following are the results of the Verification Test performed at MERADCOM during the period of 17 January 1978 to 10 April 1978. Paragraphs are referenced to the DOE "Performance Standards for Demonstrations" criteria.

- (a) Acceleration. 50 km/h in 14 s.
- (b) Gradeability at speed. At 25-km/h can traverse a 14.7-percent grade based on calculation from acceleration tests at 80-percent depth of battery discharge (DOD).
- (c) Gradeability limit. The vehicle should start and climb forward on a 26.5-percent grade for at least 20 s based on drawbar pull tests at 80-percent DOD.
- (d) Forward speed capability. The vehicle maintained 70 km/h for 35.3 min on the MERADCOM test track with a 5-percent grade.



Figure 1. Front/side view of the Battronic Mini Van.

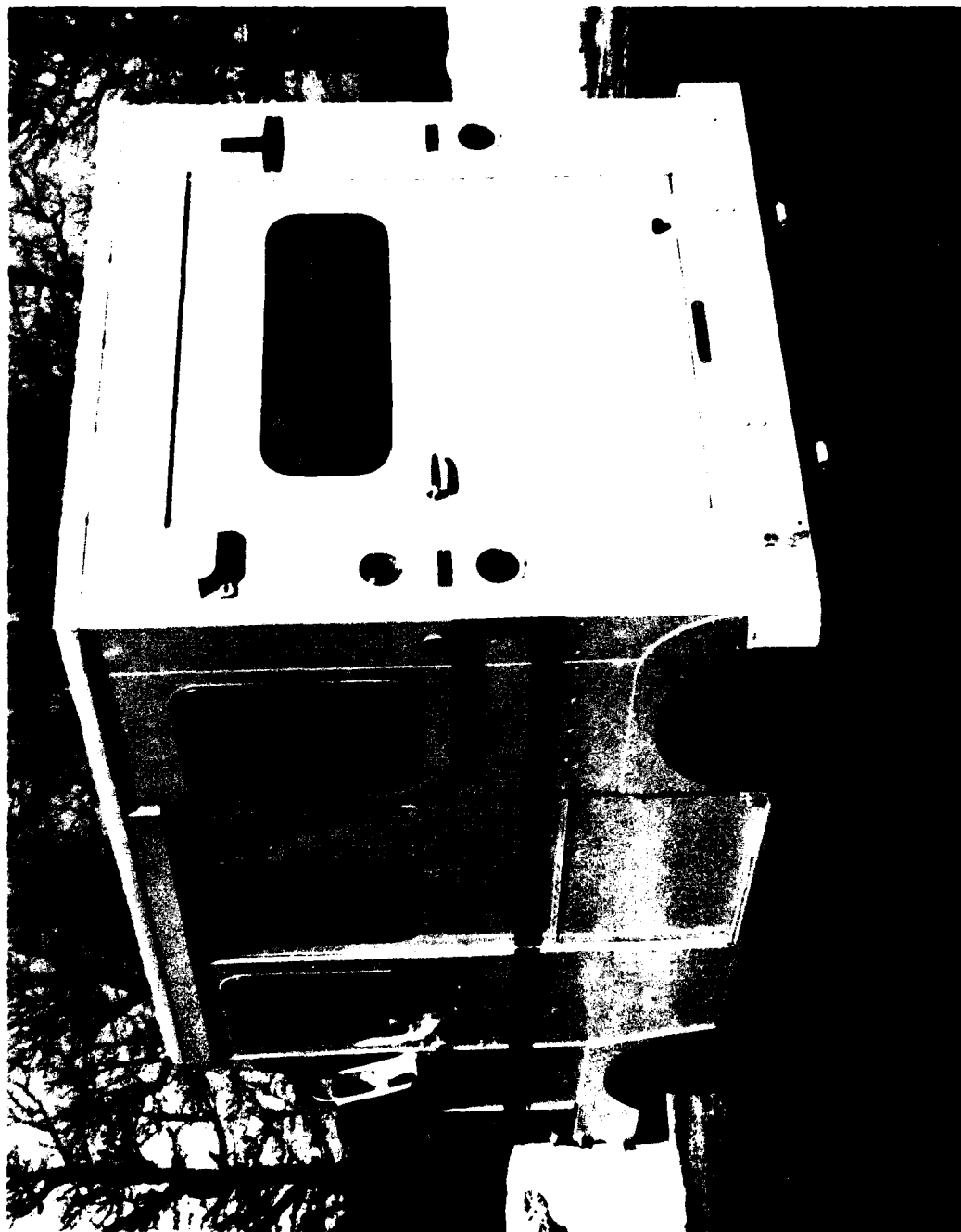


Figure 2. Rear/side view of the Battronic Mini Van.

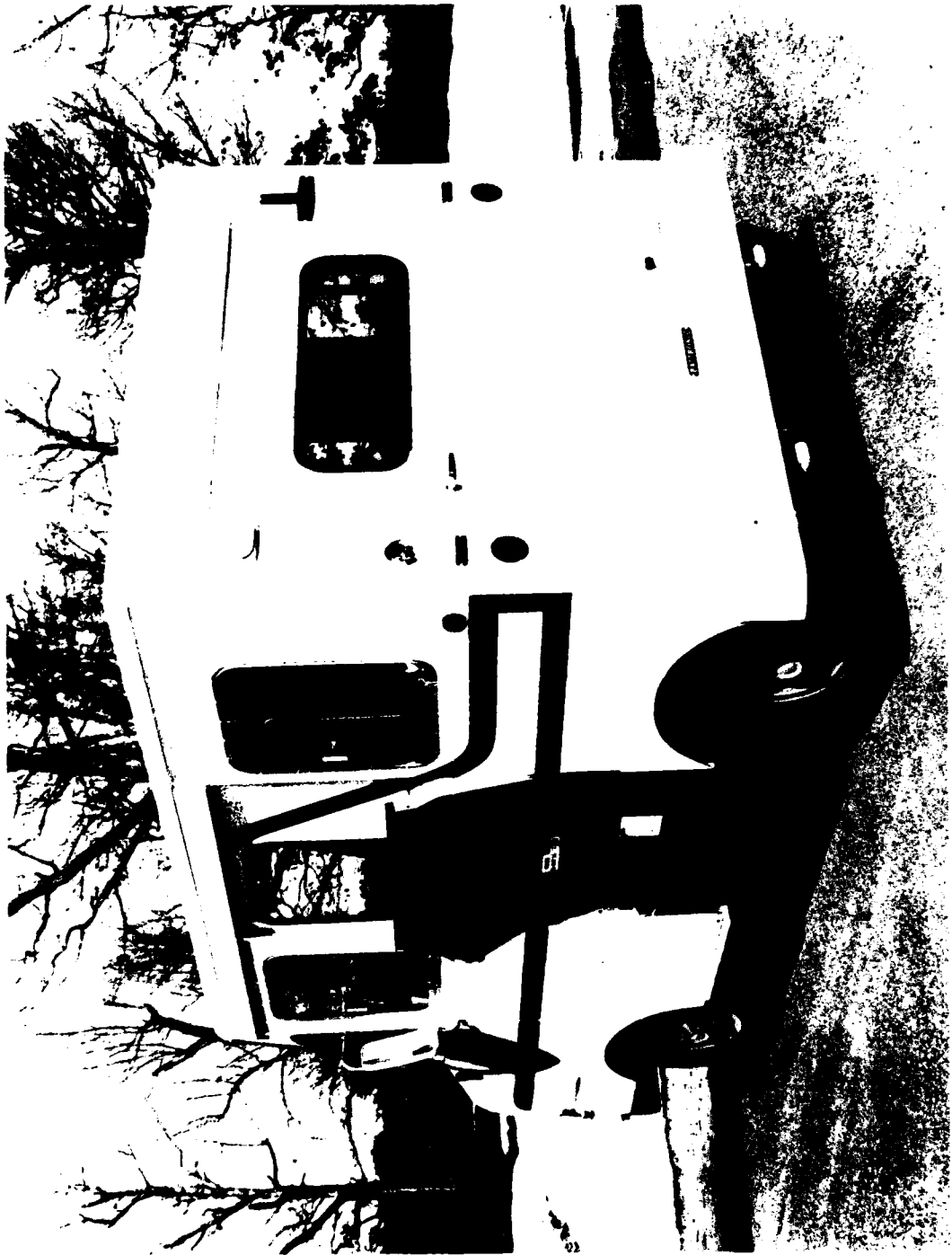


Figure 3. Side of vehicle showing one of two battery modules made by the C&D Division of the Eltra Company.



Figure 4. Access to the batteries from inside the van.



Figure 5. Access to the battery compartment.

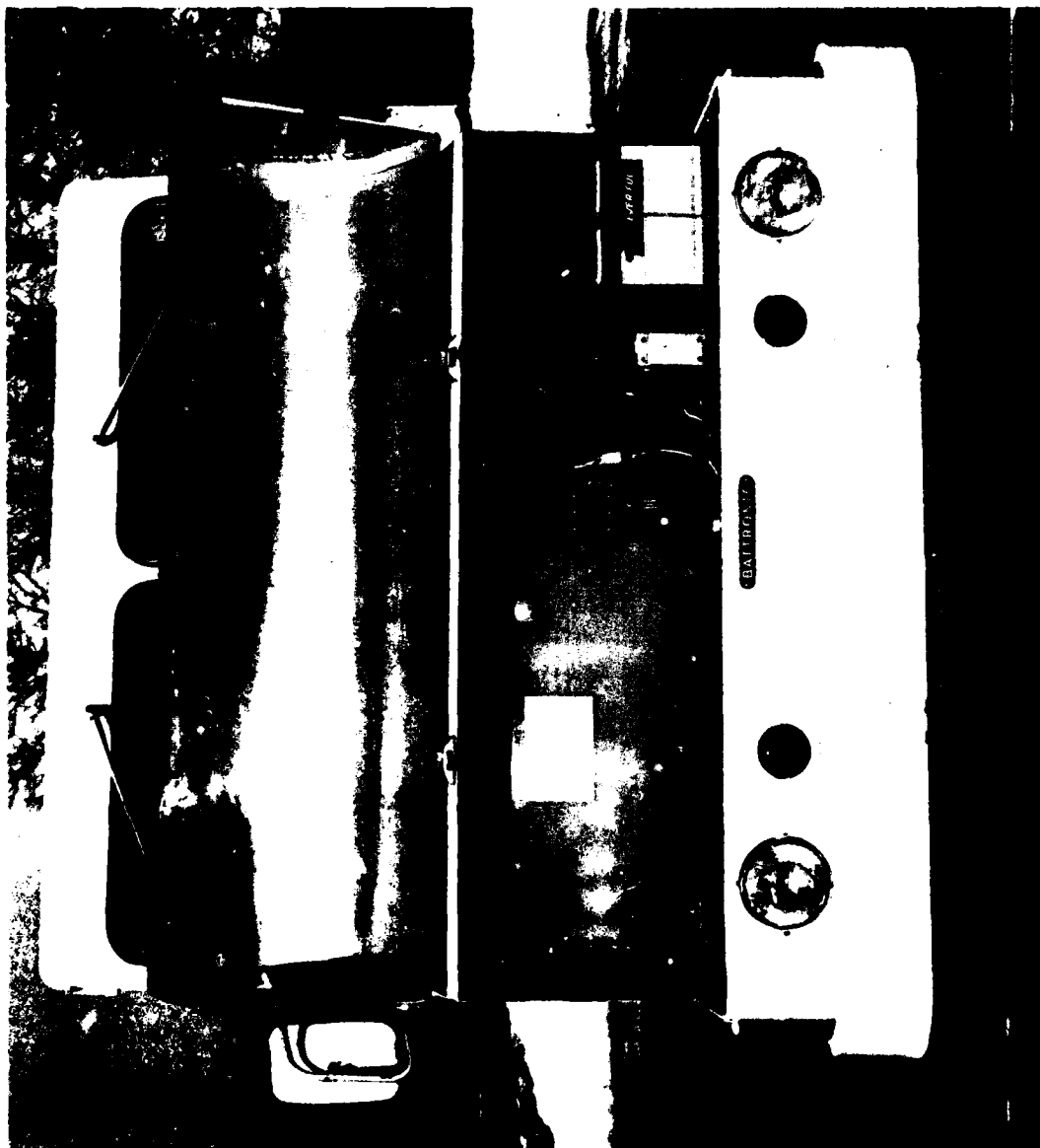


Figure 6. Control electronics, consisting of a Pulsomatic MKX SCR controller made by Cableform.



Figure 7. Titan 6000MF 12-volt auxiliary battery and controller.

- (e) Range. SAE J227a cycle "B" on level ($\pm 1\%$) terrain, 88 km, and 259 cycles.
- (f) Battery recharge time. After an 80-percent discharge, recharged vehicle with a Hert-Hertner Model SFR 56-330-S off-board charger for 10 h. After the recharge, the vehicle went 50 km to an SAE J227a cycle "B" regime.
- (g) Recharge control. Timer, with a maximum setting of 16 h.
- (h) Energy consumption. The only nonelectrical energy used is for the gasoline-fueled heater.
- (i) Battery life. No longevity tests were run specifically for verification of this criterion because of vehicle test period limitations.
- (j) State-of-charge meter. The vehicle was equipped with a state-of-charge meter.
- (k) Odometer. Yes.
- (l) Passenger comfort heater. The vehicle was equipped with a gasoline-fueled heater.
- (m) Documentation. None.
- (n) Emissions. Did not evaluate.
- (o) Safety. The Department of Transportation is performing these evaluations; however, MERADCOM performed the following limited checks:
 - (1) Electrical isolation. The Battronic Mini Van is designed to have a floating traction battery system. The frame system holding the batteries is not insulated.
 - (2) Safety standards 208 and 301. The Department of Transportation will check compliance.
 - (3) Battery caps are standard industrial battery types. Flame-barrier characteristics were not tested.

(4) Ventilation of battery compartment. There is no forced ventilation of the batteries.

(5) Battery emergency disconnect. The emergency disconnect breaks the main battery-motor circuit and is opened from inside the cab.

(6) Parked temperature effect. An 8-h hot soak at 50° C and an 8-h cold soak at -25° C revealed no operational problems at either temperature.

APPENDIX

VEHICLE SUMMARY DATA SHEET

1. Vehicle Manufacturer:

Batronic Truck Corp.
Third and Walnut St.
Boyertown, PA 19512
(215) 367-2146

2. Vehicle Description

Name: Batronic Van
Availability: In stock
Model: M065MLB
Price: \$16,500

3. Vehicle Weight

Curb Weight: 2582 kg (5860 lb)
Gross Weight: 3084 kg (6800 lb)
Payload Weight: 426.4 kg (940 lb)

4. Vehicle Size

Wheelbase: 2.39 m (94 in.)
Length: 3.683 m (145 in.)
Width: 1.88 m (74 in.)

5. Auxiliaries & Options

No. Lights: 28
Type and Function: 2 head; 2 park
a. 2 turn; 4 side markers
b. Instruments on dash and dome — 16
c. 1 backup; 1 tag
Windshield Wipers: Yes
Windshield Washers: Yes

Defroster: Yes
Heater: Yes
Radio: No
Energy Gage: Yes
Ampmeter: Yes
Tachometer: No
Speedometer: Yes
Odometer: Yes
No. Mirrors: 3
Power Steering: No
Power Brakes: No
Transmission Type: Two-speed transfer box

6. Propulsion Batteries

Type: C&D
Manufacturer: Eltra Co., C&D Batteries Div.
No. of Modules: 2
S/N: 8C03355 HEP 294
No. Cells: 56
Battery Voltage: 112V
AH Capacity: 294 A-Hr
Battery Module Size: H0.495 m (19½ in.) W0.533 m (21 in.) L0.857 m (33¾ in.)
Battery Module Weight: 572.7 kg (1260 lb)
Battery Age: C-23L GH-R
Battery Rate: 3 Hr

7. Auxiliary Battery

Type: 6000MF (GBC Group 27)
Manufacturer: Titan
No. Cells: 6
Battery Voltage: 12V
AH Capacity: 95 A-Hr
Battery Size: H0.229 m (9 in.) W0.172 m (6¾ in.) L0.298 m (11¾ in.)
Battery Rate: 20 Hr
Battery Weight: 12.3 kg (27 lb)

8. Controller

Type: Pulsomatic MKX (SCR)
Manufacturer: Cableform, Inc.
Voltage Rating: 84-140 V
Current Rating: 600 A
Size: H0.152 m (6 in.) W0.076 m (3 in.) L0.132 m (5-3/16)

9. Propulsion Motor

Type: GE-DC
Manufacturer: General Electric
Insulation Class: H
Voltage Rating: 94V
Current Rating: 390 A
HP Rating: 31.33 kW (42 hp)
Size: 0.533 m (21 in.) x 0.330 m (13 in.) DIA
Weight: 154.2 kg (340 lb)
Rated Speed: 2300 r/min
Max. Speed: 6000 r/min

10. Body

Type: Boyertown Steel
Manufacturer: Battronic Van
No. Doors: 3
Type: 2 side, 1 rear
No. Windows: 11
Type: 4 ea. side, 2 windshields, 1 rear
No. Seats: 2
Type: Driver + passenger
Cargo Volume: 4.53 m³ (160 ft³)

11. Chassis

Type Frame: Box
Manufacturer: Boyertown
Type Material: Steel
Modifications: None
Type Springs: 2 ea. 6-leaf
Type Shocks: Telescopic
Clark Axle Type Front: Tube
Axle Type Rear: Hypoid gears, flange axle shafts

Axle Manufacturer: Spicer (DANA)
Drive Line Ratio: Transmission 1.96:1, Differential 3.07:1
Type Brakes Front: Drum
Type Brakes Rear: Drum
Regenerative Brakes: Yes
Tire Type: Transport 110, 6-Ply
Manufacturer: Firestone
Size: 6.70-15
Pressure: 310 kPa (45 lbf/in²) Load range (C)

12. Battery Charger

Type: SFR 56-330-S
Manufacturer: Hertner
Off Board: Off
Input Voltage: 208/240
Peak Current: 68 A
Recharger Timer: Yes
Size: H0.660 m (26 in.) W0.495 m (19½ in.) L0.711 m (28 in.)
Weight: 113.4 kg (250 lb)
Automatic Turn Off: Yes

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